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ABSTRACT

This booklet on economics is one in a series on environmental education for grades K-12. The activities explore economic systems, levels of benefits, and the use of the cost/benefit equation to assess the value of technology in modifying the environmental quality. Four basic behavioral objectives are developed with subject areas and activities. Three activity options are listed for each objective. Information for these includes materials and resources, procedures, and discussion questions. The activities are interdisciplinary and are designed for high school students, grades 9-12. Maps, role cards, survey forms, and case studies are also given. (MA)

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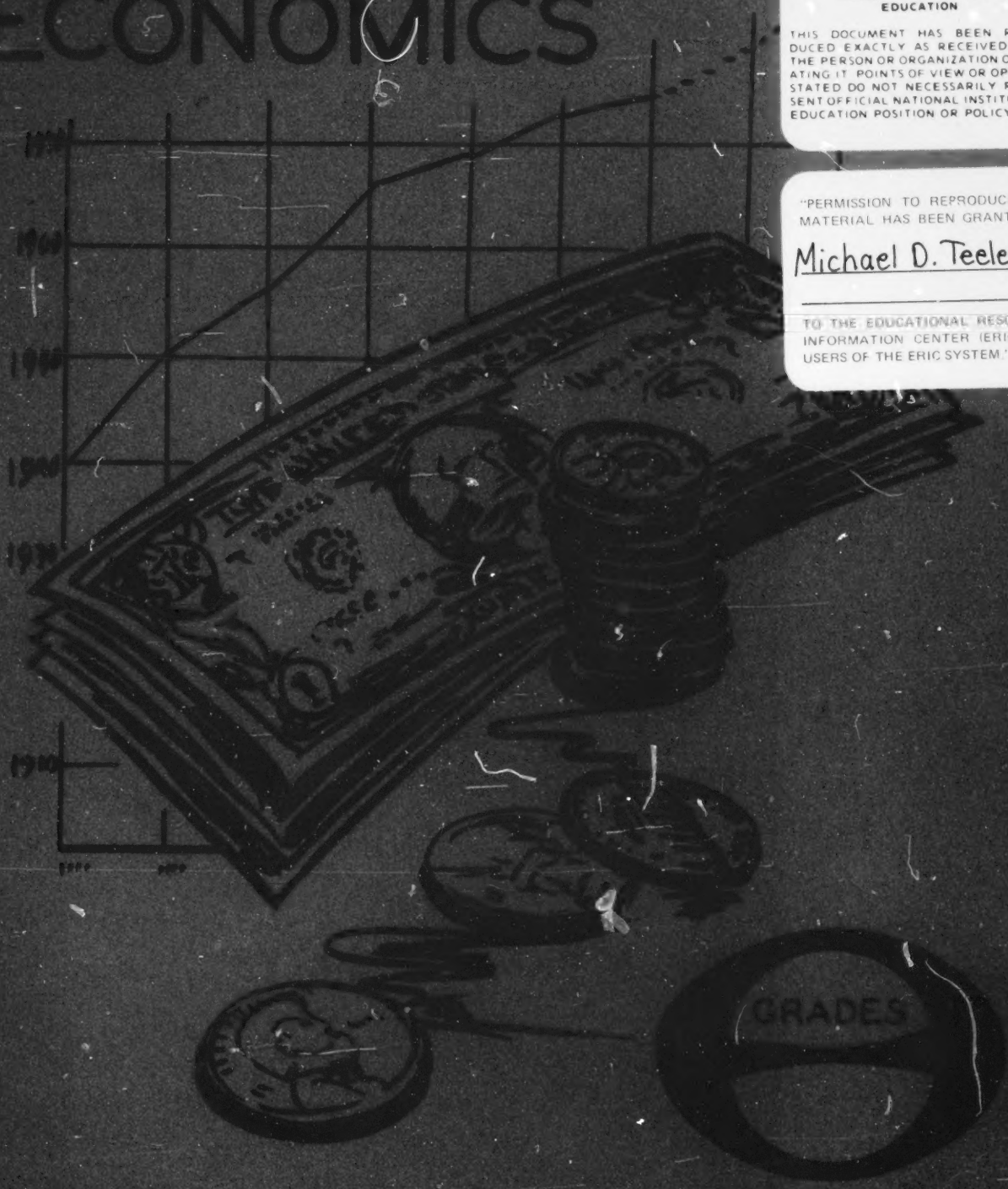
ECONOMICS



ENVIRONMENTAL EDUCATION

VALUES FOR THE FUTURE

ANTIOCH COMMUNITY SCHOOL DISTRICT 34
TITLE IV C ESEA

SE 023 462

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EXPLANATION OF CONCEPT AREA

ECONOMICS - To develop a good understanding of the decisions that will be made concerning our environment we must understand some basic economics.

We begin the study of economics with the identification of sources of money and how it is distributed. The concrete facts of money as it relates to our daily lives.

These are further developed into an understanding of wages being a result of work and the importance of man's use for resources. We then develop the basics of supply and demand by examining the role advertising and its importance to demand.

In grades 6-8 we explore the standard of living in relation to the level of technology and economic system developed by the society. This knowledge is then expanded to assess the role of economics in determining environmental quality.

In high school we explore economic systems, levels of benefits, and the use of the cost/benefit equation to assess the merit of technology in modifying the environmental quality.

ECONOMICS 10

HAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to identify the inputs and outputs of an economic system and their resulting effects on the environment.

SUBJECT AREAS:

Political Science, Social Studies, Economics, Business, Science, English

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OPTION #1 - (2-3 days)

MATERIALS

"Smog" (game by Urban Systems, Inc.)

PROCEDURE:

1. Because the directions for the game are complicated, you are urged to play the game before attempting it in the classroom. You will find also that if you do not want a number of games going on at the same time, you can make a few modifications that will enable you to get an entire class involved in one game. Instead of having one person making decisions for each of the four towns, you can have as many as three or four for each town. In addition, it is advisable to have a record keeper for each town. Depending on the size of the class you can use the remaining students as observers.

2. Before starting the game, make sure that the class understands "inputs" and "outputs" as they relate to this unit (See Glossary). It is up to you to decide whether you wish to discuss the unit understanding with the class prior to the playing of the game. It might be interesting to see whether the class can pinpoint the understanding on their own immediately after the game.

3. At the beginning of the second session, the class can explore the understanding that the game serves to develop. The economic system in this case is, of course, a municipality, not a single company. But the municipality does have inputs and outputs and they, in turn, do have an effect on the total environment. Have the class discuss these effects.

4. During this phase of the discussion, the recorders and the observers can help identify strengths and weaknesses in the management of the four cities. The game is hypothetical, however, and this discussion should last no longer than is necessary to illustrate the understanding.

5. Armed with the new understanding, the students should now be able to relate the discussion to their own community. You may require research in this phase of the exercise, but it is probably not necessary. The discussion questions should serve the purpose.

DISCUSSION QUESTIONS: (relating to the game)

1. What are the "inputs" and "outputs" of these municipal economic systems? (This checklist might prove helpful.)

INPUTS	OUTPUTS
management decisions	industrial growth
taxes	family growth
advertising expense	public relations
enforcement expense	economic health
maintenance expense	environmental health
abatement expense	quality of life
zoning expense	
interest expense	
natural resources	
technological resources	
chance (fortune)	

OPTION #1 cont.

2. In general, what is the connection between inputs and outputs?

3. In the game we have played, what were some good management decisions and some bad management decisions?

4. Which community maintained the highest environmental quality? To what extent was this the result of a) sound management? b) "outrageous fortune"?

5. Which community maintained the best balance between economic growth and environmental quality? How was this achieved?

DISCUSSION QUESTIONS: (relating to our own community)

1. Does our own community appear to reflect efficient management?

2. Are we on an economically sound footing?

3. The term environment includes much more than quality of air and water. What are some of the other ingredients in our total environment?

4. Do we have any serious environmental problems?

5. To what extent can these problems be traced back to a) bad planning? b) chance occurrences?

6. What can we do to improve the economic growth of our community?

7. What effect might these "improvements" have on the condition of our environment?

8. Is there a rule of thumb that might help us strike a balance between economic prosperity and environmental health?

9. Are there any factors at work outside of our own community that are affecting our environment?

10. In view of our economic needs, how much control do we actually have over our environment and ultimately over the "quality of our life"?

GLOSSARY:

INPUTS - Any resource, money, labor, ideas, or materials, which is used in the production of a marketable good, service or idea.

OUTPUTS - Any service, good, idea or effluent resulting from an economic system.

OPTION #2

MATERIALS AND RESOURCES

General encyclopedias

Pencil and paper

PROCEDURE:

1. The input-output problem can be easily illustrated through an investigation of the auto. Working either individually or in small groups, half of the class will develop a list(s) of raw materials that go into the manufacture of an auto. This is designed, obviously, to assess its drain on natural resources.

2. The other half of the class will develop a list(s) of resources used because of the auto and how they affect the total environment in which the auto is used. The exercise of imagination in this respect should produce a very extensive list.

3. By comparing these lists, the class should be able to gain a clear understanding of how inputs and outputs combine to affect the total environment in both postiive and negative ways.

DISCUSSION QUESTIONS

1. What raw materials are needed in the manufacture of an auto?

2. Are any of these raw materials in particularly short supply?

3. How much energy is needed to complete this manufacturing process?

4. What effect does the auto have on the physical environment?

5. What effect does the auto have on the economic and cultural environment?

OPTION #2

INPUT/OUTPUT LISTING

INPUT EXAMPLE: IRON, RUBBER, GLASS, COAL, OIL, ALUMINUM, TIN, COPPER

OUTPUT EXAMPLE: AUTOMOBILES CAUSE A NEED FOR PETROLEUM, GAS STATIONS, OIL CARRIERS, ETC.

RESOURCE	USE OR EFFECT

OPTION #3

MATERIALS AND RESOURCES

Maps of W. Polk-E. Hillsborough counties in Florida
(small circle represents the 400+ square mile area)

General information and conditions of operation pamphlets

Teacher's Guide to Alternatives and Outcomes

Specific information sheets

PROCEDURE:

1. Divide the class into three groups as follows: 10% of the class will be phosphate and TSP producers (a minimum of three people in an average class size of 25), 40% will be ranchers (about eight people), and 50% citrus grove owners (about 13 people).

2. Each group will receive a map of the area, a pamphlet of general information and conditions of operation sheets and the appropriate specific information sheets. The instructor will have identical copies of all of the above plus the list of possible alternative solutions to the problem that will develop and explanations of what were the results of actual attempts at these alternatives.

3. The instructor should guide groups into attempting settlement or gaining satisfaction in all the possible alternatives. Information provided to each group should be sufficient for them to evaluate the environmental impact and economic cost to their group of the present state of conditions. The teacher may have to act as judge and/or jury if and when groups attempt court action; and should at the appropriate time after political action is explored, declare himself to be a newly formed State Air Pollution Control District and issue the "land purchase option" edict. Then the groups should explore the likely effects and outcome of this edict and finally compare their predictions of the outcome with the actual case history provided in teacher's guide.

DISCUSSION QUESTIONS:

1. In an economic system, are legal impositions singularly effective: Would the land purchase option have been as effective if the cattle economy had been more lucrative? Why or why not?

2. Why wouldn't simple legislation against fluorine emission levels have been effective?

3. Does the bargaining alternative seem fair to you as a phosphate miner, as a cattle rancher or as an uninterested third party?

4. Why don't business ethics take into account the development of such moral issues as the Polk county incident? What makes moral issues effective as an economic factor?

5. Compare the outcome and alternatives available in this exercise under a free society to probable alternatives and outcome under a planned (centrally controlled) society.

6. Consider the possible solutions to this problem under the following conditions:

   a. optimizing citrus production
   b. optimizing cattle ranching
   c. optimizing TSP production
   d. greatest benefit to world's hungry
   e. greatest benefit to U.S. import/export ratios (maintaining balance of trade to favor GNP)

7. How can economic factors influence government action? Must government control economy? What is meant by a free economy agency in the long run? Besides the regulatory agency in this example, how does government seek to control corporations and modify economic systems?

8. Laws do not just originate from thin air. Are all laws based on economic considerations? Is there an identifiable body of laws arriving solely from economic sources? Is the land purchase option truly a law? Explain and support your answers.

9. Are "political action" and "political pressure" the same thing? What are the differences? Can either or both lead to economic favoritism and ultimately corruption and graft? How would you define the political solution to the exercise just concluded? Was such action justified? Were the results fair to all parties?

10. An economic system implies not only "peaceful co-existence" of various industries but cooperation among parties. Give some examples of cooperation in your exercise. Were there those who refused to cooperate? Why?

11. What differences, if any, exist between the phosphate companies dirtying air in the citrus groves, and the possibility of cattle ranchers refusing to fence their herds and allowing them to graze in the groves? What differences exist in possible alternatives open to the grove owners in these situations?

Phosphate Miners and Fertilizer Producers

Your group represents eleven companies engaged in mining phosphates and producing the fertilizer, triple super phosphate (TSP), needed to make domestic and foreign croplands yield produce to feed the World's masses.

This area of East Hillsborough - West Polk County has the World's largest known phosphate deposits. Your operations supply 75% of the nation's phosphate needs. Value of the raw deposits are worth over $100 million per year at the mines. Fertilizer produced from these phosphates are essential to the "green revolution". Since the early fifties, the following sequence of events has caused you to concentrate on fertilizer production at the mines:

1) Federal government limited cropland use
2) Therefore, farmers used more fertilizer of higher concentrations to increase yield per acre
3) TSP demand soared.
4) Since two ton of phosphate yields one ton of TSP, mine site TSP production cuts costs of transport roughly in half.

By 1966, you were producing 8500 ton per day of TSP.

Cattle Ranchers

Your group represents individual cattle ranchers. Your cattle represent your primary or sole income. Together your cattle graze over a range of 500,000 acres of grassland and represent between 80,000 to 120,000 head of cattle. Individual herds may be as large as 1500 head. The cattle are a hardy breed which fatten mainly on grass, being a derivative of the Indian Brahmin and well-suited for the climate in West Polk - East Hillsborough counties.

However, cattle ranching is not a bonanza. An average acre of grassland leases for $4.26. Land suitable only for grazing rarely tops a value of $150 per acre during the fiscal year, 1964.

Citrus Growers

Your group represents individual citrus grove owner-operators. You are largely retired people who depend on your lucrative citrus crops for your sole source of income. Your groves represent an investment of your life savings. Together you represent approximately 150,000 acres of productive groves in the West Polk - East Hillsborough region.

In the mid sixties a healthy citrus grove is worth approximately $4,000 per acre. The same acre but unplanted goes for about $300.

You raise fifteen percent of the nation's supply of citrus produce and a full quarter of Florida's output of citrus.

Crop values total over $50 million per year. Operation is year round.

General Information and Conditions of Operation

1. TSP production causes release of Fluorine gas and particulate Fluorides during the chemical processing of the ore and the curing/storage of the fertilizer.

2. Raw ore contains three to five percent Fluorine by weight.

3. Cattle are affected by Fluorine and Flourides as follows:

   a. loss of appetite and weight
   b. mottling of teeth
      AT THIS STAGE RECOVERY IS POSSIBLE IF ANIMAL IS ISOLATED FROM TOXIN.
   c. Fluorine replaces Calcium in joints and bones. Movement becomes painful and weakened skeletal system causes collapse.
   d. vomiting and bloody diarrhea
   e. Lumps and spurs appear at joints and stiffness causes immobility.
      AT THIS STAGE RECOVERY IS IMPOSSIBLE.
   f. starvation and death

For the above to occur pollution levels of forage must exceed 40 PPM by weight for an extended period or the cattle may be exposed to a single massive dose.

4. Citrus groves are affected by Fluorine and Fluorides as follows:

   a. Fluorine gas enters leaves.
   b. slows or stops photosynthesis
   c. opposes plant use of nutrients that are synthesized
   d. Fruit number, weight and Vitamin C content are all lowered. Fruit rind thickness increases.

These effects occur at concentrations of 5-16 PPB* by volume in air.

5. TSP plants are unaffected by Fluoride and Fluorine gas concentrations.

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* PPB - parts per billion

CONDITIONS

A. Some grove acreage when tested is found to rarely have lower pollutant fluorine levels than 10 PPB from November to April, with highs of 50 PPB.

B. Some pastures showed concentrations of Fluorine pollutants in the 200 PPM range for terms of over four weeks and common levels throughout were found to be approximately 100 PPM.

C. Winter and Spring pollutant levels are highest because 1) seasonal sale increase of TSP in January through May 2) numerous temperature inversions in three months and 3) prevailing fickle wind patterns often reversing direction and covering the same land over three times.

D. Winter coverage of pasture could reach at times a level of 40 PPM over a range of 500 square miles.

E. Winter and early spring are especially vulnerable times for both cattle and citrus groves due to new buds in the groves and lowered nutrient value of pasture grasses.

F. There exists no legal property rights to air. However, under common law, a site owner has a strong claim to having clean air above his site.

G. Factories are dumping 14 million pounds yearly of Fluorine and Fluorides into the air.

H. No insurance is in effect or written to absorb or spread losses due to Fluorine pollution for either ranchers or grove owners.

I. TSP production is sporadic from time to time depending on market conditions, inventory, etc.

J. Irrigation of groves is non-productive during high pollutant levels.

K. Land values due to increased Fluorine pollution have already dropped by ten percent on pasture land and five percent on citrus groves. 12

General information and conditions of operations con't

L. To control Fluorine emissions the following cost tables are guidelines.

Percent change Control level		Additional expense per plant
97 - 98 %	1.0	$350,000
98 - 98.6%	.6	$400,000
98.6 - 99%	.4	$525,000
99 - 99.2%	.2	$700,000

Older plants built during the early 1950's cannot feasibly achieve more than 96% control.

TEACHER'S GUIDE

Possible (Farmer) Alternatives for Discussion

ALTERNATIVE I. New Economic Inputs

A. Cattlemen

1. Substitute non-polluted feeds
2. Transport cattle to low Fluorine level grasses

B. Citrus growers

1. Enclose groves
2. Introduce other crops impervious to Fluorine

ALTERNATIVE II. Court Action - Individual plaintiffs must show

A. Fluorine in the air/on the pasture

B. Which company is responsible to what degree or that they, the company, are acting in concert

C. Prove destructive effect is due to Fluorine only

ALTERNATIVE III .Bargain with Phosphate Companies (pay them to control their pollution)

A. Individual bargaining

B. As a union of

1. Cattlemen
2. Farmers
3. Both

ALTERNATIVE IV. Political Action

A. Disperse propaganda to all media

B. Create a public moral issue

C. Pressure Federal, State and local government officials into directing themselves to the problem

Actual Results and Effectiveness of the above Alternatives

ALTERNATIVE I. Inputs: Both inputs available to cattlemen were implemented with little economic success. The inputs were simply too costly for the meager rate of return in cattle ranching.

The enclosing of citrus groves is obviously a ridiculously costly alternative and was never seriously considered. Introducing other crops might have been feasible but would do nothing to ease the citrus growers economic crunch. This is an example of destroying an economy to save it.

ALTERNATIVE II. Court Action: This was tried mainly by citrus grove owners due to the expense of court action. Mostly these actions were unsuccessful. Obviously, at expense to the grove owner, tests can be made to show Fluorine in the air but to show which companies are responsible to what degree for the resulting damage is nearly impossible given variables in TSP production, wind changes, etc. Furthermore, proving destructive effect is not easy since there are multiple possible causes of the same citrus damage. Some of the possible causes are a.) improper or excessive deficient fertilizer b.) incorrect amounts or application periods of irrigation and c.) several types of disease cause similar damage to groves. Finally the TSP producers need only show reasonable doubt as to their responsibility for the damage. The burden of proof and court expense is all borne by the farmer. One successful court action brought an award of $208,000. The judgement went against a single phosphate company for both ranchers and grove owners immediately adjacent to the plant. The areas over which the charges were proven were within a mile of the Fluorine source, thereby eliminating some of the problems mentioned above.

ALTERNATIVE III. Bargain with the Phosphate Company:

A. As individuals the cost involved in paying off the companies is obviously too great as is the risk of paying the wrong company to control its Fluorine emissions.

B. As organized bargainers, problems crop up as follows:

1. Free riders - those who wait to see if they can get something for nothing and don't join the union
2. Again, who do you pay and how much? The conditions are too variable.
3. Costs of constantly policing the agreement involve expensive testing by professional people
4. What recourse do the grove owners and cattlemen have, if the companies fail to keep their bargain?

ALTERNATIVE IV. Political Action: This avenue when finally and vigorously pursued resulted in satisfactory settlement of the issue. All three approaches were used and public pressure resulted in the creation of a State Air Pollution Control District with rights to specify use of air over all parties' lands and funds with which to police these standards of quality.

The District imposed a "land purchase option" on the phosphate companies stating effectively that they must either lower their Fluorine emissions to the minimum technically feasible levels or buy the land polluted by their operations beyond tolerance levels for intended usage. This edict had two important economic results:

1. The cost of pollution was at once transferred from the grove owners and cattle ranchers to the phosphate companies.
2. It made the phosphate companies land owners and, therefore, economically interested in the well-being of cattle and citrus groves.

Land values went up. The companies in choosing the "least cost combination" of cleaning their emissions and/or purchasing land would be willing to pay the minimum value for the land in its polluted state plus a greater value not exceeding the cost of implementing a system to clean their exhausts sufficiently not to pollute that same land. From 1958 until 1964 land values for grazing rose $7 to $40 per acre. Citrus grove property was already so valuable as to not increase accordingly.

Land purchase in any case was the cheapest route after cleaning emissions had reached the 99.5% level. By 1964 TSP production had doubled but resulting Fluorine emissions had fallen to 5 million pounds yearly. Phosphate company-owned land had increased to eighty percent and to defray costs their lands were leased to ranchers and citrus growers. By 1966 state emission standards were imposed near the technological limits and land purchase ceased.

Millaro
Glenfield
Kathleen
Galloway
Lakeland
Winter-
haven
Winston
Knights
Dover
Plant
City
Lutner
TAMPA
Mango
Eaton Pk.
Turkey
Sydney
Highland
City
Eagel
L.
Brodon
Valrico
Hopewell
ILLSBOROUGH
Nichols
P
O
Bart
Durant
Riverview
Gibsonton
Adison
Pierce
Boyett
Bradley
Agricola
Balm
Winsuma
Garwood

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ECONOMICS 11

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain that economic systems have different points of maximum gain dependent upon desired outcomes of the systems.

SUBJECT AREAS:

Social Studies, Business, Economics, Political Science, English

OPTION #1 - five classroom periods

MATERIALS AND RESOURCES

SVE filmstrips*- case studies Machiasport, Maine; Merrimac River Valley; Chesapeake Bay Area; East Coast Megalopolis

PROCEDURE:

1. Explore the economic aspects of the development of the St. Lawrence Seaway:

   a. events leading to the development of the seaway
   b. benefits derived from the seaway
   c. detrimental aspects of the seaway

2. Students will be given time to research the events leading up to the development of the seaway with a follow-up discussion of the pros and cons.

3. This will be followed by research and discussion of the results of the opening.

DAY 1-2 RESEARCH

1. Events leading up the building of the seaway

   a. The need for the seaway
      (1) cheaper shipping methods
      (2) economic growth
   b. Developmental agencies
      (1) St. Lawrence Seaway Development Corporation, U.S.
      (2) St. Lawrence Seaway Authority, Canada
   c. Proposed benefits of the seaway
      (1) tax revenues
      (2) power project
      (3) general public improvements
      (4) tourism
      (5) business expense
   d. Possible adverse effects
      (1) economic effects on existing ports, for example, New York
      (2) environmental problems, if any
   e. Compare the U.S. and Canadian economy
      (1) goals
      (2) differences
      (3) similarities

DAY 3

Students will debate the pros and cons of building the seaway based upon the information found that led to the building of the seaway.

DAY 4

Research the actual economic and environmental results of the opening of the seaway.

OPTION #1 con't

DAY 5

Discuss the economic and environmental impact of the opening of the seaway on society.

*Filmstrips listed above are optional.

DISCUSSION QUESTIONS

1. What approaches were used by Canada and the U.S. in determining the need for the seaway?
2. How were the costs of building the St. Lawrence Seaway divided between the two countries?
3. List the benefits that were derived from the seaway by each country.
4. How was it determined who received these benefits?
5. How were the adverse effects of building the seaway evaluated by each country?
6. What were some of the specific environmental problems generated by the opening of the seaway?
7. What effects did each of these problems have on the economy?
8. How are the environmental problems that arose being dealt with by each country?

OPTION #2 - four days

MATERIALS AND RESOURCES

Role cards

PROCEDURE:

In this option an attempt is being made to show the differences in the decision-making process between a planned and free economy and the resulting environmental effects.

PROBLEM: ASU and ROSU are just emerging as industrial powers. Both have traditionally been agricultural countries. Each country has thirty billion dollars to spend either on the rising pollution problem or the development of strip mining of coal. ASU represents a free economy and ROSU represents a planned economy.

1. Divide the class into groups: ROSU (5-7 students) and ASU (the remainder of the students in the class) and present the situation.

2. Have each group research the operation of a planned versus a free economy, if necessary.

3. Divide ROSU people in half with one student acting as a chairman and issue role cards. Divide ASU group into subgroups representing executive, legislative and judicial plus one or two students representing the following pressure groups: business, labor, agriculture and environmental protection agency. Issue role cards to subgroups and pressure groups.

4. Have each group decide upon a basic set of economic goals from which to work.

5. Start the group meeting by having the executive and chairman read a "state of the union" message to their respective groups.

6. At the conclusion of group meetings, have the chairman and executive read decisions reached and rationale to class.

7. Proceed with the following discussion questions.

DISCUSSION QUESTIONS

1. What are the differences and similarities between a planned and free economy?

2. How does each economy determine its goals?

3. How do the goals affect the people in a planned versus free economy?

4. How does each type of economy deal with the allocation of its resources?

5. Based upon the ASU and ROSU group, which type of economy had the least difficulty in arriving at a decision?

6. Which economy had the most freedom of choice and participation, i.e. the making of the decision?

7. In each type of economy what was sacrificed to achieve maximum gain?

8. What impact did the goals of each system have on the environment?

OPTION #2 ROLE CARDS

ASU Business

You represent large corporations. You wish to keep profits high. You are acting as a pressure group to force the legislature to develop the stripmining operation. Stripmining development will increase profits, give you a greater ability to pay taxes and thus provide more benefits for society at large, provide more and cheaper fuel and improve the standard of living.

ASU Agriculture

You represent the food-producing element of society. You will serve as a pressure group to force the expenditure of funds on the environment. Environmental control will maintain more usable land area for food production, provide cleaner water for irrigation and animal consumption, cause fewer health problems and provide a higher standard of living.

ASU Environmental Protection Group

You represent the concerned citizen who wishes to maintain an environment that will sustain life in a manner that is suitable and pleasing for most individuals. You are serving as a pressure group to spend the $30,000,000,000 on Environmental Control. Environmental Control will avoid future environmental crises and astromical costs to correct them at that point, if they can corrected at all, provide a more beautiful world in which to live, bring about fewer health problems and produce a higher standard of living.

ROSU Executive

You are chairman of central committee. You will make the final decision between spending $30,000,000,000 on a new stripmining operation or an environmental improvement project.

ROSU Environmental Advisors

You are the advisor in favor of the environmental protection projects. Some of your reasons are:

1. Maintain more usable land for food production
2. Cleaner water for irrigation and animal consumption
3. Cause fewer health problems
4. Avoid future environmental crises and astronomical costs to to correct them.
5. Provide more beautiful world
6. Provide improved standard of living

ROSU Industrial Advisors

You are the advisors in favor of the stripmining operation. The economy is sagging. Unemployment is high. Working man has difficulty supporting his family. Some reasons in favor of stripmining are the generating of more jobs, producing higher wages, generating more buying power, increasing business profits, giving businesses more taxable income, thus providing greater benefits for all of society, providing cheaper fuel and improving the standard of living.

OPTION #2 ROLE CARDS

ASU Executive

$30,000,000,000 is available
You are making the recommendation that this money be spent on environmental improvement because of the serious pollution problems that are arising.

ASU Legislative

$30,000,000,000 is available
You are recommending that this money be used for development of several large strip mines to give the sagging economy a boost.

ASU Judicial

You must serve as the arbitration board for the various decisions that must be made. Your discussions are based upon the sets of values and goals your group has established.

ASU Labor

You represent the working man. Unemployment is high. It is becoming increasingly difficult to support your families. You, therefore, are serving as a pressure group to force the legislature to develop the strip mining operations. Strip mining development will generate more jobs, produce higher wages, generate more buying power and improve your standard of living.

OPTION #3 - no specific materials

PROCEDURE:

1. Separate the class into at least seven groups. Have each group represent a particular type of economic society. Each of these societies will be based essentially on one of the following economies: tourism, farming, heavy industry, hunting, fishing, mining or lumbering.

2. Each group will make a list of the probable effects that its major industry will have on the total environment of that society. The list will include both the beneficial and the adverse effects. (Chart 1)

3. Using the lists the teacher will ask the class, in open discussion, to suggest procedures that might 1) assure the continuance of each of the beneficial effects and 2) eliminate or at least minimize each of the adverse effects.

4. This discussion may present a problem. As someone suggests a method of alleviating an adverse effect, the result may be to reduce or even eliminate one or more of the benefits. The problem will be to establish, for each society, a functional balance between economic goals and environmental health.

5. The final observation should be in the form of comparative evaluation. The evaluation can be written or oral and should assess the varied effects that these differing economic systems will have on the total environmental scene.

DISCUSSION QUESTIONS:

The discussion questions are to be developed by the instructor according to the content of the student-developed lists.

OPTION #3

ECONOMY FACT SHEET

TYPE _____

NEEDS	EFFECT OR COST
1.	
2.	
3.	
4.	
5.	
7.	
8.	
9.	
10.	

ECONOMICS 12

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain why the cost/benefit equation used to determine the value of a particular technological advance should also include the environmental costs of using the technology.

SUBJECT AREAS:

Science, Social, Studies, English, Art

OPTION #1

MATERIALS AND RESOURCES:

Politics of Energy FS/C, available E^2 Office
Selected articles from the Social Issues Resource Series
Energy and the Land, Human Issues in Science FS/C, available E^2 Office

PROCEDURE:

1. Discuss the role of oil in our society.
2. List as many uses as possible for oil, including byproducts.
3. View the filmstrips and listen to the cassettes.
4. After having seen and heard some of the possible effects on the environment, evaluate your feelings concerning the use of energy.

DISCUSSION QUESTIONS:

1. How does the current energy crisis threaten us?
2. Is finding more oil a solution? Why or why not?
3. How are we going to have to alter our way of life to be consistent with the world energy supply?
4. How has technology affected our use of energy?
5. Are we misusing technology?
6. Who should pay the costs of "cheap" energy?
7. How do we measure the value of energy? How should we?
8. How might the entire world population, both human and animal, be affected by this "new" energy?
9. Is it necessary for an oil company or any company to make a profit? Why or why not?
10. What special needs does the energy company have?
11. Would the least costly technological advance for the company necessarily be in the best interest of the people over a long period of time? Explain.
12. Would you be willing to pay more for gas and oil so that the environment might be preserved? Why or why not?

OPTION #1 BIBLIOGRAPHY

The following selections are articles from the Social Issues Resource Series.

POLLUTION VOLUME 1

"Nuclear Energy and the Environment", by Irene McManus. American Forests, August 1973.

"Southwest Colossus: Power and Pollution", by Leory F. Aarons. The Washington Post, June 6, 1971.

"Superships, Superhazards", by Jim Hamptom. The National Observer, November 16, 1974.

ENERGY VOLUME 1

"Can a Nuclear Plant Be a Good Neighbor?", by Jonathon Braun. Parade, January 20, 1974.

"Clean Fuel Being Made from Coal", by Michael Woods. The Toledo Blade, December 9, 1973.

"Energy vs. Environment: The Coming Struggle", by Eric Hirst. The Living Wilderness, Winter 1972/73.

"Environment and Energy". Exploring Energy Choices, The Ford Foundation, 1974.

"Our Lives May Be at Stake", by Margaret Mead. Redbook, November 1974.

"Ralph Nader Reports: Unsafe Nuclear Plants". Ladies Home Journal, November 1974.

"Solutions to Energy Crises Could Threaten Lifestyles", by Larry Pryor. The Los Angeles Times, June 3, 1973.

OPTION #2

MATERIALS AND RESOURCES

Survey forms for each student

PROCEDURE:

1. Distribute survey sheets to each student.

2. Discuss the understanding to be developed and see how your collection of data can give you some insights to the concept.

3. Discuss the questions after the survey is taken.

4. Call a utility company in town and see how much rates have increased in the past twenty years.

DISCUSSION QUESTIONS:

1. About 150 years ago it took eight days to go from Detroit to Chicago by stagecoach. Discuss the costs of such a trip compared to taking the same five-hour trip today.

   a. Do the price increases today compare with the time and energy saved?
   b. Is the safety factor today better? Does the weekend mortality rate of our state verify your answer?
   c. What do most people do with the time they save?

2. Medical costs obviously have increased over the past 100 years.

   a. How many doctors do you know who will make house calls?
   b. Compare the diagnosis of a problem over the telephone to a doctor actually being with the patient.
   c. Discuss the advantages of emergency medical service solving some of the present problems. Call your city hall to find out the daily cost of having these emergency units on call. Do you gain any benefits from them? How?

3. Several years ago the electric company promised that there would be discount rate given to any family who had numerous electric items in their household. Little discount was ever experienced. Obviously the opposite effect has taken place.

   a. Why did the reverse effect occur?
   b. Why should "John Doe" pay more for the use of electricity?
   c. Why isn't the greater use of electricity by the public making it less expensive to the public?

OPTION #2

WHAT DID YOU PAY FOR THESE ITEMS?

	PARENTS	GRANDPARENTS	GREAT GRANDPARENTS
AUTO			
RADIO			
TELEVISION			
GASOLINE			
ELECTRICITY			
BREAD			
ICE CREAM			
DOCTORS			
ADDITIONAL			

1. WHAT DO YOU FEEL IS THE BASIC CAUSE OF THE CHANGE OF PRICES YOU HAVE EXPERIENCED IN YOUR LIFETIME?
   A. PARENTS:
   B. GRANDPARENTS:
   C. GREAT GRANDPARENTS:
2. DESCRIBE THE STYLE OF LIFE YOU USED TO KNOW.
   A. PARENTS:
   B. GRANDPARENTS:
   C. GREAT GRANDPARENTS:
3. IN GENERAL, COMMENT ON WHETHER YOU FEEL THE INCREASED COSTS YOU HAVE EXPERIENCED OUTWEIGH THE BENEFITS GAINED OR VICE VERSA.
   A. PARENTS:
   B. GRANDPARENTS:
   C. GREAT GRANDPARENTS:

3/

USE REVERSE SIDE FOR ADDITIONAL COMMENTS.

OPTION #3

MATERIALS AND RESOURCES

Individual auto dealers

Item cost list

Almanac for data on air pollution

PROCEDURE:

1. Break students up into pairs.
2. Their goal is to build or design the best auto possible, with maximum pollution controls on their vehicle.
3. Explain they have $6,000 to make their auto.
4. They must work within that budget. You will want a list of costs and a list of benefits or things that would improve the auto from the present day car.
5. Students are to use the costs of materials on our list for basic components.
6. Have students illustrate their autos and defend their innovations.
7. Open class for discussion to try to illustrate the concept of cost.
8. Have one group prepare a chart on the break down of the tax dollar spent on air pollution.
9. Point out that the sum spent when compared to the reasons is a cost/benefit equation.

DISCUSSION QUESTIONS

1. How much does the average auto cost today?
2. Do we forget anything about the concept of cars?
3. Where do our tax dollars go?
4. What are some of the environmental problems caused by the auto?
5. Do these problems cost money? Are there other ways we can look at cost?
6. Have we considered environmental costs while building our car?
7. Does anyone know what the word "cost" means?
8. How much is it going to cost to implement pollution controlling devices?
9. Do we normally consider environmental costs in technology?

OPTION #3

ITEM COST LIST

ITEM (each)	COST	POLLUTION EFFECT	REASON FOR CHOICE
1. Tires (4)	$ 100	-	NA
2. 4 cylinder engine	400	+5	
3. 6 cylinder engine	800	+10	
4. 8 cylinder engine	1200	+30	
5. compact auto	2000	+10	
6. medium auto	3000	+20	
7. full size auto	4 000	+30	
8. radio	100	+ 2	
9. air conditioning	500	+20	
10. power steering	500	+10	
11. power brakes	400	+ 5	
12. disc brakes	300	+ 3	
13. fuel injection	400	- 5	
14. two barrel carburetor	100	+5	
15. four barrel carburetor	200	+15	
16. high mileage transmission	200	+ 5	
17. low mileage transmission	250	+15	
18. pollution control A	200	- 5	
19. pollution control A+B	300	-10	
20. pollution control A+B+C	600	-15	
21. if 4+7+9+15+17 add	-	+30	
22. if 2+5, +13, +16 add	-	-10	
23. handling package*	100	-	
24. comfort package**	100	-	

* special shocks and alignment for roadability
** special upholstery, windows, trim, etc.

REFERENCES

Ehrlich, Paul and Anne H., Population, Resources and Environment, W. H. Freeman and Company, San Francisco, 1970.

Jackson, Wes., Man and the Environment, W. C. Brown Company, Dubuque, Iowa, 1971.

Crocker, Thomas and A. J. Rogers III, Environmental Economics, The Dryien Press, Inc., Hinsdale, Illinois, 1971.

Caldwell, Lynton Keith, Environment, Doubleday and Company, Inc., Garden City, New York, 1971.

Meadows, Donella and Dennis L., The Limits to Growth, Potomac Associates Bk., New York, 1972.

A Curriculum Activities Guide to Water Pollution and Environmental Studies, Volume One, Tilton School Water Pollution Program, Tilton, New Hampshire.

BEHAVIORAL OBJECTIVE:

At the completion of this unit the student will be able to explain how economic and environmental capacity interrelate.

SUBJECT AREAS:

Science, Social Studies, Economics, Mathematics

OPTION #1 - TIME: 3 periods

MATERIALS AND RESOURCES

Planning the Human Community module, E^2 Office

PROCEDURE:

1. The game is self-contained and has explicit directions. The following points are for your consideration.

   a. Be certain they realize that they make two budgets, one trial and one final.

   b. Explain the quality of life environmental impact and bonus points.

   c. Point out that for every quality of life point they need two thirds of an environmental impact point, i.e. environmental impact points are harder to overcome than quality of life points.

   d. Point out that certain areas should be left alone, e.g. sites 17 and 7 on page 2.

   e. Water plants should be put in near the end of the budget planning.

   f. Be sure they understand they need 8000 jobs.

   g. Point out the correlation between industry and power needs.

   h. When they choose a site for recreation they can also put one additional feature on the site, e.g. zoo or golf course.

   i. Solid waste has two options with widely different costs.

2. Divide the class into four groups and explain to them that to complete this in two periods they will have to divide up the tasks for the group.

   e.g. power - two people
   industry - two people
   recreation - two people
   accountant - one person

3. By the end of the first period they should be halfway through the initial budget. By the end of the second period they should be able to complete the revised budget.

4. Successful teams will be able to get into the grey area on the cover graph.

5. Use the third period for discussion and evaluation.

OPTION #1 continued

DISCUSSION QUESTIONS

1. How would you define quality of life?
2. What was the economic capacity of your society?
3. What was the environmental capacity of your society?
4. Did you consider having less than 8000 jobs?
5. How would you modify the figures for Environmental Index and Quality of Life to make them more realistic?
6. Were you able to get into the grey area on the budget graph?

OPTION #2 - TIME: Two periods

MATERIALS AND RESOURCES

Film, The Tragedy of the Commons, available E^2 Office

PROCEDURE:

1. Show the film without introduction and discuss at the stop points.

2. Continue discussion and suggest research into the advent and process of government conservation programs in the area of farmland usage, for example, proper farming techniques to conserve volume of topsoil and nutrient content.

DISCUSSION QUESTIONS

1. What motivating factor caused the commons to be grazed out? Could you as an individual living in that time have restrained from increasing your herd size? Would you have limited your herd?

2. If the farmers had a local governing body to limit and enforce the proper usage of the commons would that have solved the problem? Who should decide what is proper usage of the resources available? What should the penalty be for misuse?

3. As the population, both cattle and herders, increased the environment deteriorated until the commons could no longer support the community. Does increased economic growth always result in decreased environmental conditions? How does the growth of cities compare to the increased population of cattle on the commons?

4. Why are large industrial cities usually situated on lakes or sea coasts? What happens to the water quality as the cities' capacity for production grows? Can you as a citizen of Chicago do anything to maintain or restore the water quality of Lake Michigan? Can you as an employee of U.S. Steel do anything to control effluent from that plant into Lake Erie? Can you as a resident on Channel Lake do anything to improve sewage treatment of residents' septic emptying into the channel?

5. Fluorocarbons from aerosal sprays may be depleting the ozone layer in the upper stratosphere. This will allow more ultra-violet light to fall on the earth and cause increased skin cancer in all mankind. Should manufacturers be forced to stop production? Who should decide? The USSR has few if any such sprays.

6. If you were a Russian diplomat would you insist that as part of a trade agreement with the U.S., the U.S. must ban aerosal sprays? Should the U.S. insist the USSR stop building and flying SST's for the same reasons? If such agreements were made, how could they be enforced?

7. In all instances of increased economic potential we have cited, there was an accompanying population growth. If the population size was limited in some way, would environmental deterioration still result from economic growth? Is economic growth possible without population growth? Support your answer!

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OPTION #3 - TIME: one to two periods

MATERIALS AND RESOURCES

Tables 1 and 2

Graphs 1 and 2

Graph paper

PROCEDURE:

1. The Club of Rome - a philanthropic organization commissioned the development of a computer simulation model of the environment. In the simulation they were able to vary factors like available food, pollution, population, gross national product, etc. This unit uses some of the data to create two graphs to represent the current situation and the situation with double the world resources.

2. Give each student a copy of the table to create three graphs. The first graph will compare the relative economic growths of seven countries. The second and third graphs will portray the data from current information and with more resources.

3. When the students complete their graphs analyze the data depicted. Transparencies of the two large graphs included make it easier for the class to see.

4. Pay particular attention to pollution, food, and industrial output per person.

DISCUSSION QUESTIONS

1. Using Table 1, how have the various countries increased their economy since 1900? Does the size of the country matter much, note U. S., Sweden, Japan. (3,615,122; 173,732; 143,751 square miles respectively)

2. Now look at your second and third graphs. What happens when resources are doubled? Why do you think pollution went up?

3. Why do you think food/capita stayed somewhat the same?

4. What do you think happened to population during this period? (Answer: It suffered a major dieback when pollution rose.)

5. What might have kept pollution in check? (Hint: Look at the curves for industrial output.)

6. How does pollution relate to available resources?

7. How does pollution relate to industrial output per person?

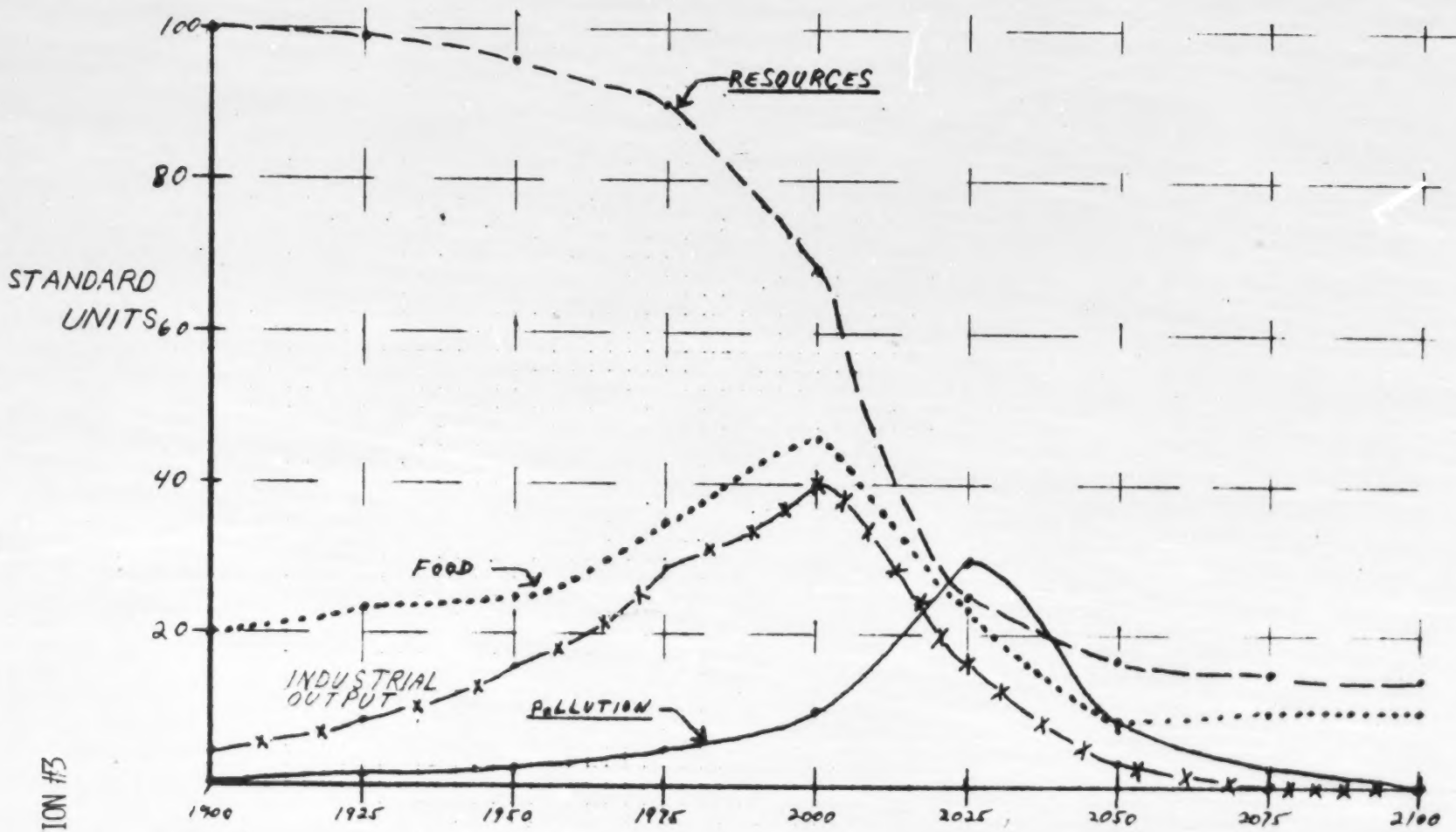
8. Can you predict what might occur if the rate of increase of resource use was decreased, or stabilized? Can this occur?

9. In graph 1 why did everything but food per person decrease?

WORLD COMPUTER MODEL

GRAPH 1

40

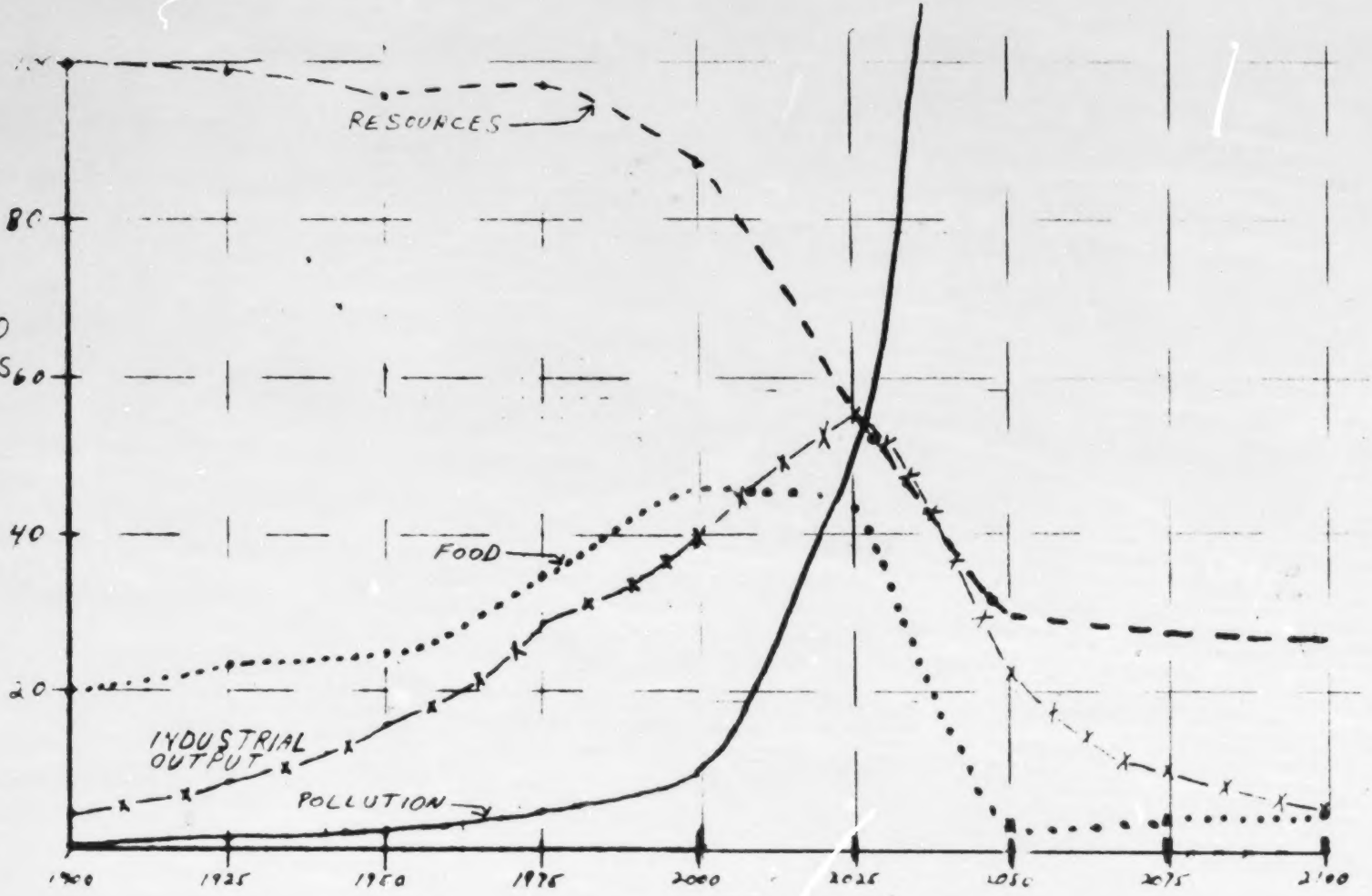


OPTION #3

WORLD COMPUTER MODEL

GRAPH 2

RESOURCES DOUBLED



OPTION #3

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OPTION #3

TABLE 1

ECONOMIC GROWTH RATES — U.S. DOLLARS/PERSON

	U.S.	SWEDEN	U.K.	JAPAN	ARGENTINA	GHANA	INDIA
1900	1300	600	900	200	450	200	75
1950	2500	2000	1600	500	700	275	76
1970	3600	2750	1850	900	800	350	77
2000	11000	5000	2450	23200	1000	500	140

OPTION #3

TABLE 2

Computer data for 1900 - 2100 (est.) for world factors. All values are in standard units.

Date	pollution	resources	food	industrial output/capacity
1900	0	100	20	4
1925	1	100	23	8
1950	2	96	25	16
1975	5	90	35	28
2000	10	68	46	40
2025	30	25	23	17
2050	9	17	9	3
2075	2	15	10	0
2100	0	14	10	0
	If we double available world resources			
1975	+0	+6	+0	+0
2000	+0	+21	+0	+0
2025	+0	+28	+20	+39
2050	$+\infty$	+15	-6	+19
2075	$+\infty$	+12	-6	+10
2100	$+\infty$	+12	-6	+5

$+\infty$ = off the scale, too great